HUNTSMAN

Enriching lives through innovation

PRODUCT SAFETY SUMMARY:

BISPHENOL-A-BASED LIQUID EPOXY RESIN (BLR)

This Product Safety Summary is intended to provide a general description of certain Huntsman chemical substances and products containing the chemical substance(s). The information in this Summary is not intended to replace the information included on the Safety Data Sheet (SDS), Product Safety Label, and other safe use and handling literature for the chemical substance(s).

Chemical Identity

This Product Safety Summary covers the chemical substance below:

Name	Molecular Weight	Other Identifiers
Bisphenol-A-based liquid epoxy resin (BLR)	<700	Bisphenol A diglycidylether (BADGE) 2,2'-[(1-methylethylidene)bis(4,1-phenyleneoxymethylene)]bisoxirane Oxirane, 2,2'-[(1-methylethylidene)bis(4,1-phenyleneoxymethylene)]bis; CAS: 1675-54-3

General Product Overview

In Huntsman, bisphenol-A-based liquid epoxy resins (BLR) are used to produce formulations, chemicals and polymers. BLR is marketed by Huntsman for use by industrial, professional, and chemical producers. A small percentage of BLR is marketed by Huntsman directly for “do-it-yourself” (DIY) consumer use; however, consumer exposure to BLR is expected to be limited by its small quantities in use, low volatility, and use patterns that result in dilution with hardeners and a curing process.

BLR is a reaction product of bisphenol-A and epichlorohydrin. Due to the nature of the process and the final product, bisphenol-A is almost fully consumed and only parts per billion traces are detectable. The same for epichlorohydrin, which is removed during the purifying and cleaning process.

Applications and Uses

Bisphenol-A-based liquid epoxy resins are used as part of two-component systems to create epoxy coatings and adhesives, as well as in the manufacturing of certain electronic components and composite parts. In some minor applications, BLR is used as an additive and stabilizer.

Potential routes of human (i.e., worker) exposure to BLR is through dermal contact and, to a minor extent, through inhalation in spray application or when heat cured. Ingestion is not an anticipated route of exposure. Worker exposure can occur in industrial facilities where the substance is produced or formulated into end-use products or used as an industrial intermediate. Within this assessment, both industrial workers and trained professionals are evaluated. In general, all of the worker situations are controlled to avoid any direct contact with the BLR, either through process engineering controls, procedural controls and/or through the use of personal protective equipment.

The substance has limited applications where consumers are likely to come into contact with the material. These are limited to products such as some adhesives, fillers, and putties that come in a two-component packaging, often in a two-tube delivery system that requires mixing immediately before application. In general, these systems are designed to minimize the potential for direct exposure. However, the use of gloves is strongly advised and highlighted in the outer package of the DIY BLR products.

The cure time for these products varies from minutes to hours. The BLR begins to polymerize once mixed with hardeners, eventually being consumed into the polymer adhesive matrix.

Physical and Chemical Properties

BLR is a clear to yellow viscous liquid.

Certain physical properties are summarized below – this chart is specific to BADGE:

Melting/freezing point	-16.0°C (BLR can crystallize even at ambient temperatures)
Boiling point	>320°C (decomposition temperature stated)
Vapor pressure	4.6 x 10-8 Pa @ 25°C
Density	1.16 g/cm3 @ 20°C
Partition coefficient (LogKow)	3.242 @ 25°C

Additional physical and chemical property information is available on the product Safety Data Sheet (SDS), which can be requested at SDS@huntsman.com.

Human Health Information

The probability of experiencing health effects associated with exposure to BLR is considered negligible provided the recommendations stated in the material safety data sheet are implemented and followed. Adverse health effects are subject to dose level, route, and duration of exposure. BLR is classified as a category 1 skin sensitizer under the Globally Harmonized System (GHS) for Hazard Communication, so if exposure occurs an individual's susceptibility should also be considered.

The potential health effects from exposure to BLR are discussed below. Different regulatory classification criteria apply in different geographic regions. These different criteria may result in different human health regulatory classifications for the same product in different geographic regions. Specific regulatory classification information is contained in the Safety Data Sheet for

each product in use in specific geographic regions. The acute and chronic health effects information set forth below is based on Safety Data Sheets in use in the United States.

Acute Health Effects

Acute exposure of humans to BLR by inhalation is highly unlikely due to the low vapor pressure. Acute animal tests in rats, mice, rabbits, and guinea pigs have demonstrated BLR to have low acute toxicity by ingestion and from dermal exposure. Animal studies and exposure-related observations in humans have identified skin-sensitizing properties of BLR resulting in symptoms of erythema, dermatitis, and eczematous reactions developing on exposed skin.

Skin contact may cause no to moderate local irritation and may produce an allergic skin reaction in sensitive individuals. Ingestion of BLR may cause digestive tract burns.

Eye contact may cause no to moderate eye irritation with symptoms of redness and conjunctivitis.

Chronic Health Effects

Repeated or prolonged exposure to BLR by oral ingestion at >50 mg/kg body weight per day has shown slight decrease in body weight and food consumption in rats. Inflammation and chronic dermatitis have been observed in rats during prolonged exposure.

In reproductive/developmental toxicity studies, toxicity on fertility, teratogenic, or fetotoxic effects were not observed in the rats exposed orally to BLR.

Extensive experimental studies have been conducted, and the weight of evidence indicates that BADGE appears to be genotoxic in non-animal test systems. Following animal testing, BLR did not show positive evidence for carcinogenicity, mutagenicity, or genotoxicity.

More information can be obtained in the specific product Safety Data Sheet.

Environmental Information

During normal operating conditions, BLR is not expected to be released to the air, soil, or water. Procedural and/or control technologies are used to minimize emissions and potential exposure during cleaning and maintenance activities. Before it is used, BLR is mixed in semi-closed systems (pails, cartridges etc.) with other chemicals and/or monomers (additives/colorants and hardeners), which inherently mitigates any hazardous properties via dilution.

Environmental Fate

BLR is susceptible to indirect photolysis, which results in yellowing of cured products. BLR hydrolyses rapidly when in contact with water. There is limited mineralization at concentrations exceeding environmental concentrations and the biodegradation rate will not exceed the well-established rate of hydrolysis. BLR is not expected to be bio-accumulative.

Environmental Toxicity Testing

Environmental toxicity test data from several aquatic species show that BLR does present toxicity at concentrations below the limit of water solubility (<10 mg/L). The lowest aquatic toxicity value for BLR was determined in an Organisation for Economic Co-operation and Development (OECD) Test No. 211 (Daphnia magna Reproduction Test) – the No Observed Effect Concentration (NOEC) was 0.3 mg/L). As a result, BLR is classified as Aquatic Acute and Chronic Category 2 under the Globally Harmonized System (GHS) for Hazard Communication. More information can be obtained in the product Safety Data Sheet.

Potential Occupational Exposure

In Huntsman, BLR is manufactured in closed systems. During normal operating conditions, occupational exposure to BLR is not expected in the manufacturing process. Procedural and/or control technologies are used to minimize exposure during sampling, cleaning, maintenance, or in more open handling systems. In those cases, appropriate engineering controls (such as ventilation) and personal protective equipment should be used in accordance with the exposure guidelines and workplace practices identified in the Safety Data Sheet.

Potential Consumer Exposure

BLR is marketed by Huntsman as a formulation component of adhesives and putties, directly for consumer use. However, risk of exposure is limited by the application of dual cartridges that mix the BLR with the hardener components when expelled by consumers, the use of gloves and the little quantities typically used.

Safe Use Recommendations/Workplace Exposure Controls

Huntsman follows and recommends that customers follow workplace exposure guidelines through a variety of industrial hygiene and ventilation measures. Workplace exposure

guidelines include workplace limit values.

The following values are referenced by the National Institute for Occupational Safety and Health (NIOSH) for diglycidyl ether[1], which may be considered protective of workplace exposure to BLR.

Diglycidyl ether

- Occupational Safety and Health Administration (OSHA): 2.8 mg/m^3 (TWA)
- NIOSH: 1 mg/m^3 (ceiling 15 min)

OSHA has a validated sampling and analytical method available to evaluate potential exposures to airborne BLR (Method 1018)[2].

Because of the possibility of sensitization, employees who are assigned to an epoxy resin work area should undergo a pre-placement medical evaluation and be part of a comprehensive medical surveillance program. Once a worker has been diagnosed as sensitized to any epoxy resins, no further epoxy resin exposure should be permitted.

See the Safety Data Sheets for BLR and specific epoxy-based products for additional information about first aid measures, accidental releases (spills and leaks), waste disposal, toxicity, transportation, regulatory requirements, and other important topics.

Regulatory Information/Classification and Labeling

Under the Globally Harmonized System (GHS) for Hazard Communication, substances are classified according to their physical, health, and environmental hazards. The hazards are communicated via specific labels and the Safety Data Sheets. GHS attempts to standardize hazard communication so that the intended audience (workers, consumers, transport workers, and emergency responders) can better understand the hazards of the chemicals in use.

The hazard statements and symbols presented here refer to the hazard properties of the concentrated substance and are meant to provide a brief overview of the substance's labeling. It is not intended to be comprehensive or to replace information found in the Safety Data Sheet.

[1] https://www.cdc.gov/niosh/docs/79-104/default.html
[2] https://www.osha.gov/dts/sltc/methods/validated/1018/1018.pdf

Labeling according to OSHA 1910.1200 (GHS)

Signal Word
Warning

GHS Classification	
Skin irritation	Category 2
Eye irritation	Category 2A
Skin sensitization	Category 1
Aquatic acute	Category 2
Aquatic chronic	Category 2

Hazard Statements	
H315	Causes skin irritation
H319	Causes serious eye irritation
H317	May cause an allergic skin reaction
H411	Toxic to aquatic life with long-lasting effects

Additional Information

Information on registered substances is available on the European Chemicals Agency (ECHA) website at https://echa.europa.eu.

References

Pearce, D., (2013) Bisphenol A Diglycidyl Ether of Bisphenol A, Methods Development Team Industrial Hygiene Chemistry Division, OSHA Salt Lake Technical Center, Sandy, Utah 84070-6406, U.S.A.

Glycidyl ethers, IARC Monographs Vol. 47, pp 238 - 261.

Disclaimer

The information and recommendations in this publication are, to the best of our knowledge, information and belief, accurate at the date of publication. NOTHING HEREIN IS TO BE CONSTRUED AS A WARRANTY, EXPRESS OR OTHERWISE.

IN ALL CASES, IT IS THE RESPONSIBILITY OF THE USER TO DETERMINE THE APPLICABILITY OF SUCH INFORMATION AND RECOMMENDATIONS AND THE SUITABILITY OF ANY PRODUCT FOR ITS OWN PARTICULAR PURPOSE.

THE PRODUCT MAY PRESENT HAZARDS AND SHOULD BE USED WITH CAUTION. WHILE CERTAIN HAZARDS ARE DESCRIBED IN THIS PUBLICATION, NO GUARANTEE IS MADE THAT THESE ARE THE ONLY HAZARDS THAT EXIST.

Hazards, toxicity, and behavior of the products may differ when used with other materials and are dependent upon the manufacturing circumstances or other processes. Such hazards, toxicity, and behavior should be determined by the user and made known to handlers, processors, and end users.

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